



BACTROX HYPOXIC CHAMBERS

OPERATION MANUAL

MODEL: BACTROX

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IMPORTANT: READ THIS INSTRUCTION MANUAL IMMEDIATELY.

Your satisfaction and safety require a complete understanding of this unit, including its proper function and operational characteristics. Be sure operators are given adequate training before attempting to put the unit in service. **NOTE: This equipment must be used only for its intended application; any alterations or modifications will void your warranty.**

1. ORIENTATION

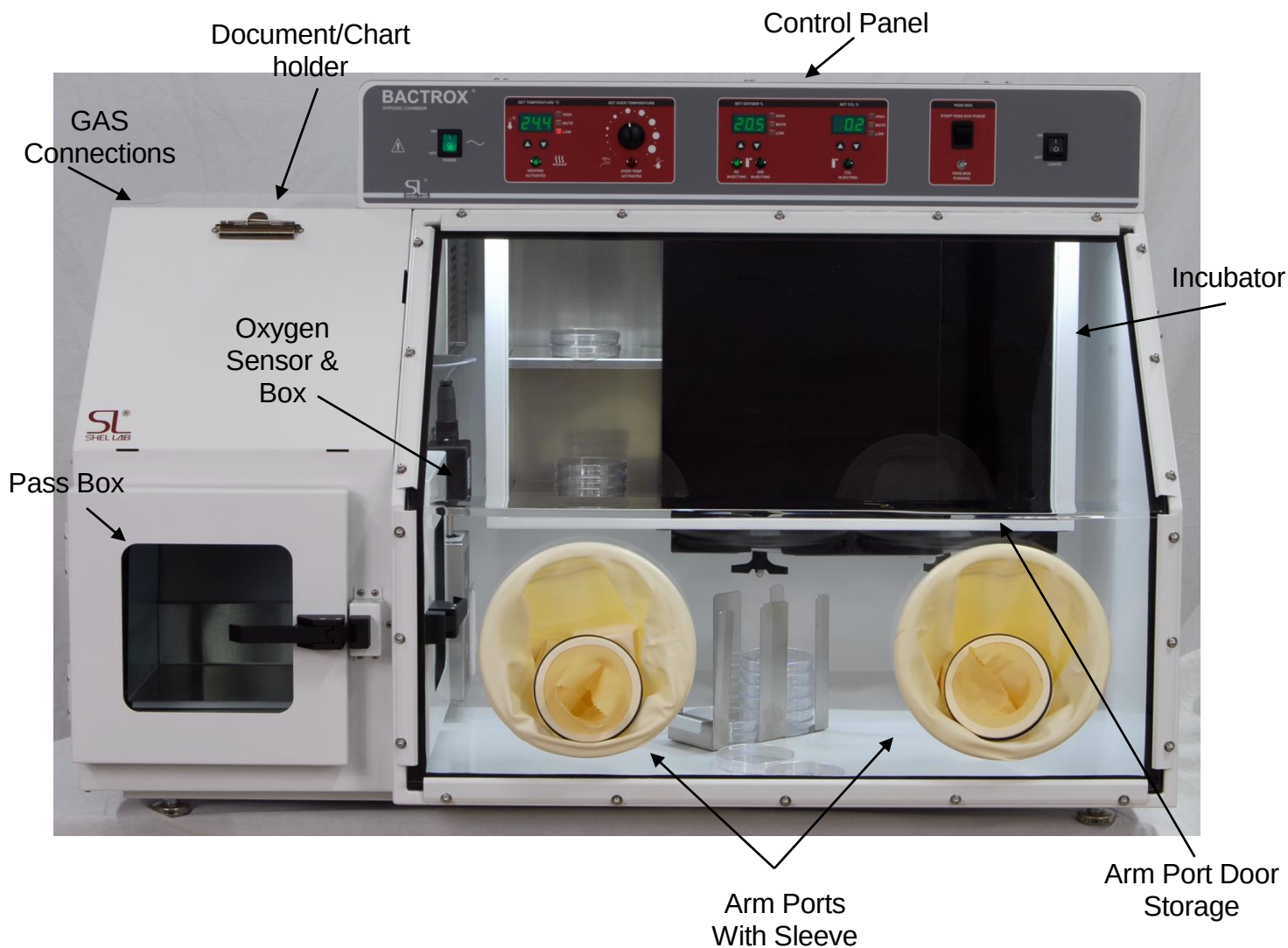




Figure 1: Sleeve/Cuff Assembly

The Sleeve/Cuff Assembly consists of a neoprene sleeve, a plastic cuff ring, O-Ring, and a soft rubber cuff. Unit comes with Latex Gloves and Cuffs. Nitrile Gloves and Cuffs may be ordered from the Parts List. The assembly allows gloveless chamber operation.

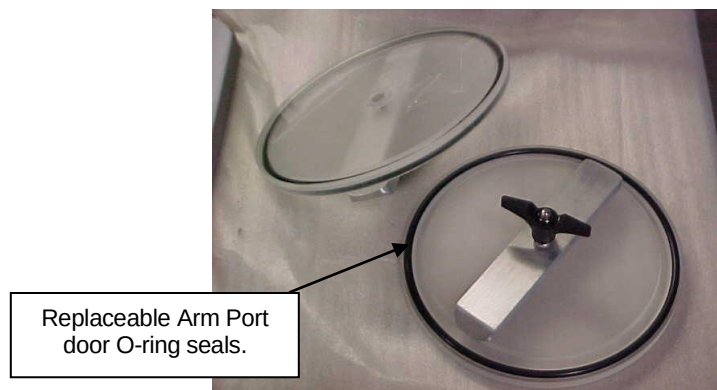


Figure 2: Arm port Doors

CAUTION: The Bactrox chambers have an efficient method of sealing the chamber by utilizing the Arm port doors as shown in Figure 3. The tightening knob on the Arm port doors should be turned just until the knob begins to “grab”. **DO NOT OVER TIGHTEN.** Damage can occur if too much force is placed on the Arm port door assembly.

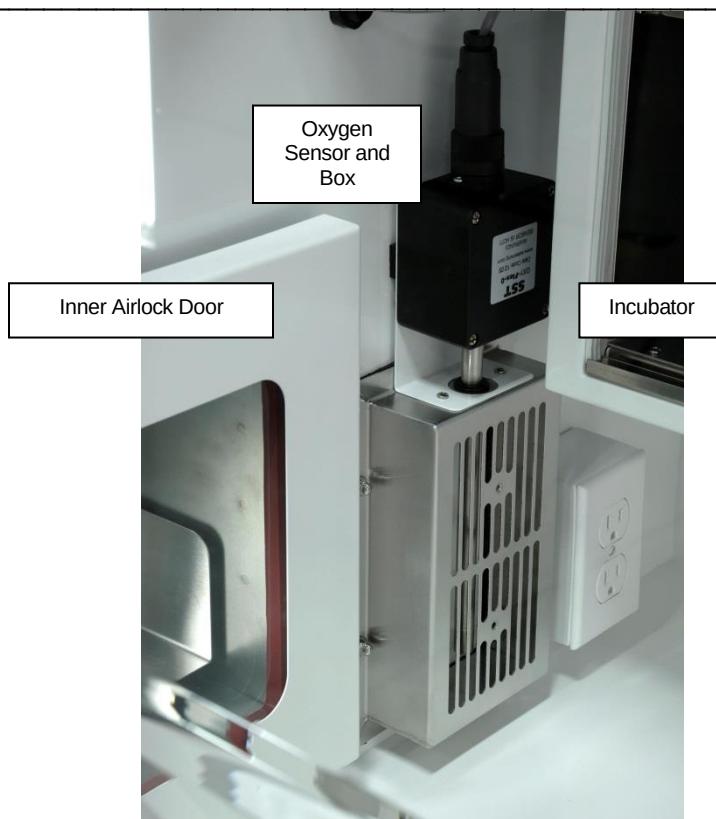


Figure 5. Pass Box

The PASS BOX provides ability to take material into and out of the chamber. PASS BOX can be operated either automatically or manually. The PASS BOX shelf allows for materials to be conveniently rolled from the PASS BOX into the chamber.

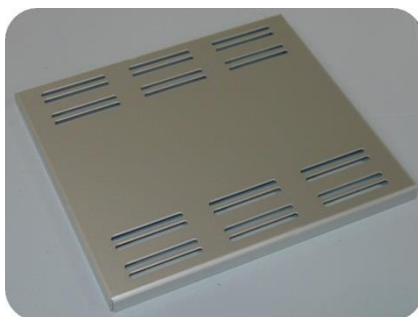


Figure 6: Incubator Bottom Shelf Spacer

Three (3) are provided with the Bactrox. Refer to Section 8 for installation and precautions.

2. RECEIVING AND INSPECTION

- 2.1 The carrier, when accepting shipment, also accepts responsibility for safe delivery and is liable for loss or damage claims. On delivery, you must inspect for visible exterior damage. Note and describe on the freight bill any damage found and enter your claim on the form the carrier supplies.
- 2.2 Inspect for concealed loss or damage on the unit itself, both interior and exterior. If any, the carrier will arrange for official inspection to substantiate your claim. Save the shipping crate until you are sure the unit has been delivered in good condition.
- 2.3 If for any reason you must return the unit, contact your sales representative for authorization and supply nameplate data.

3. INSTALLATION

- 3.1 Local city, county, or other ordinances may govern the use of this equipment. If you have any questions about local requirements, please contact the appropriate local agency.
- 3.2 Under normal circumstances these units are intended for use indoors, at room temperatures between 5° and 40°C, at no greater than 80% relative Humidity (at 25°C) and with a supply voltage that does not vary by more than 10%. These chambers should not be operated at an altitude exceeding 2000 meters. Installation category is CAT-II.
- 3.3 Pollution Degree 2. Customer service should be contacted for operating conditions outside of these limits. Installation may be performed by the end user. It is unnecessary for this unit to be installed by a technician.
- 3.4 **Location:** In selecting a location, consider all conditions that might affect performance, such as heat from radiators, ovens, autoclaves, etc. Avoid direct sun, UV light sources, fast-moving air currents, heating and cooling ducts, and high traffic areas. Allow a minimum of 10 cm between the unit and any walls or partitions that might obstruct free airflow and to promote easy access to the power cord and source. Under normal circumstances this unit is intended for use indoors.
- 3.5 **Power Source:** The unit power requirements are listed on the data plate. Check the data plate for voltage, cycle, and ampere requirements. Plug the power cord into a PROPERLY GROUNDED (earthed) Power source OF THE CORRECT SIZE AND STYLE INDICATED ON THE UNIT NAMEPLATE RATING. A separate circuit is recommended for this unit to prevent loss of product due to overloading or circuit failures caused by other equipment. The supply voltage must match the nameplate voltage within +/- 10%. The US market units are designed for 120 VAC @ 60 Hz, 12.0 Amps. The EU market units are designed for 230 VAC @ 50/60Hz, 6.0 Amps. If supplied with a detachable cord set, plug the female end into the inlet on the unit and the male plug into the supply. Assure that units requiring fuses have them installed. The fuse is a T type, 12.5 Amp for 110 volt units, 10 Amp for 220 volt units. This fuse may be at the inlet or a part of the cord set male plug.
- 3.6 **Leveling:** The unit must sit level and solidly. Leveling feet are supplied and must be installed in the four holes in the bottom corners of the unit. With the feet installed and the unit standing upright, each foot can be raised by turning it in a counterclockwise direction. Adjust the foot at each corner until the unit stands level and solid without rocking. If the unit must be moved, turn the leveling feet in (clockwise) all the way to prevent damage while moving.
- 3.7 **Lifting and Handling:** CAUTION: Use appropriate lifting devices that are sufficiently rated for these loads. Failure to do so could result in minor or moderate injury. Units should only be lifted from their bottom surfaces. Handles and knobs are not adequate for lifting or stabilization. The unit should be completely restrained from tipping during lifting or transport. All moving parts such as trays or covers should be removed during transfer to prevent shifting and damage.
- 3.8 **Cleaning:** Appropriate lab practice includes cleaning and disinfecting the unit prior to use. Your operating conditions and appropriate protocol will determine the correct procedure for cleaning. A typical cleaning procedure is described below and will help reduce the likelihood of contamination and the necessity of decontamination. Clean the unit regularly. Depending on usage and protocol, this may be weekly, monthly or quarterly. Cleaning the unit does not qualify the unit as decontaminated.

WARNING: Follow these safety precautions regardless of the cleaning procedure. Failure to do so may cause serious injury or death.

- Always disconnect the unit from the electrical service when cleaning.
- Assure all volatile or flammable cleaners are evaporated and dry before reconnecting the unit to the power supply.

NOTICE: Follow these precautions regardless of cleaning procedure. Failure to do so may cause property damage and void your warranty.

- Special care should be taken when cleaning around sensing heads to prevent damage.
- The Bactrox unit was cleaned at the factory, however, a general cleaning is recommended. Use BENZALKONIUM CHLORIDE to clean your chamber. See list of chamber accessories products. Do not use chlorine-based bleaches, ammonium-based disinfectants or aerosol canisters or abrasive cleaners. These will modify the powder coated and stainless steel interior finishes and create a biologically toxic atmosphere inside the chamber.
- Do not use hard tools such as metal wire brushes or steel wool. Use non-abrasive cleaners and soft tools such as plastic brushes.

Typical Bactrox Cleaning Procedure

- Remove the condensate collection vessel pan every week, wash with soap and water, and then disinfect with 70% alcohol solution. Replace in the chamber.
- Remove all shelves, shelf supports, shelf standards and shields. Wash and disinfect as described in item 1. For initial set up, clean and disinfect shelving parts prior to installation.
- Wash and disinfect all interior surfaces including inside the incubator.
- Replace all N₂ and CO₂ filters every six months or when noticeably dirty on the upstream side. CO₂ and N₂ filters are located in the shadow box just behind the GAS IN fitting and in line with the CO₂ tubing kit and inside the pump box in the shadow box.

- 3.9 Gas Source:** Install the gas regulator(s) on the tank(s) of gas. Chain the gas tanks(s) to a secure position on the wall. **Set the regulator(s) to 15 psi.**
- 3.10** To achieve a hypoxic (1-20% O₂) environment we recommend using a tank of pure Nitrogen (N₂).
- 3.11** To achieve a hypoxic atmosphere enriched with carbon dioxide (1-20% CO₂) we recommend a tank of pure Carbon Dioxide (CO₂).
- 3.12** N₂ must be connected to N₂ PORT. CO₂ must be connected to the CO₂ Port.



Figure 7

4. CONTROL PANEL OVERVIEW

- 4.1 **POWER:** The I/O (ON/OFF) switch controls all of the power for the chamber and must be in the I/ON position before any systems are operational. Both "SET TEMPERATURE" "SET O₂ %" and "SET CO₂ %" displays will illuminate when the power switch is in the ON position.
- 4.2 **SET TEMPERATURE:** This controller is marked "SET TEMPERATURE" and indicates the actual temperature within the chamber to 0.1°C. The UP/DOWN buttons are used for inputting the set point, calibrating the display, and muting or unmuting the audible alarm. The HIGH and LOW alarm indicators will light whenever there is an alarm condition associated with the temperature within the chamber. The MUTE indicator will light whenever the audible alarm has been deactivated.
- 4.3 **HEATING ACTIVATED LIGHT** Heating activated light will be lit whenever the main incubator heating element is on.
- 4.4 **SET OVER TEMPERATURE:** This is a hydraulic thermostat that is wired between the Main temperature controller and the heating element and functions as an override control. During normal operation, if at any time the "SET Temperature" control fails in the ON position, and the temperature in the incubator rises above its set point, the "SET OVER TEMPERATURE" is activated and maintains temperature at its own set point. Note that the HEATING ACTIVATED LIGHT indicator will not continue to function while overridden by Over Temperature Limit.
- 4.5 **OVER TEMPERATURE ACTIVATED LIGHT:** This pilot lamp is on whenever the "SET OVER TEMPERATURE" safety thermostat has been activated and taken control of the heating element. During normal operating conditions this indicator should never be on.
- 4.6 **OXYGEN CONTROL:** This controller is marked "SET OXYGEN %" and indicates the percentage of O₂ content within the chamber to 0.1%. The UP/DOWN buttons are used to input the set point, calibrating the display, and muting or unmuting the audible alarm. The HIGH and LOW alarm indicators will light whenever there is an alarm condition associated with the O₂% within the chamber. The MUTE indicator will light whenever the audible alarm has been deactivated.
- 4.7 **N₂ INJECTING:** This pilot lamp is on whenever the oxygen control has been activated and is actively injecting N₂ gas via the solenoid valve.
- 4.8 **AIR INJECTING:** This pilot lamp is on whenever the oxygen control has been activated and is actively injecting air via the solenoid valve associated with the air supply pump.
- 4.9 **CO₂ CONTROL:** This controller is marked "SET CO₂ %" and indicates the percentage of CO₂ content within the chamber to 0.1%. The UP/DOWN buttons are used to input the set point, calibrating the display, and muting or unmuting the audible alarm. The HIGH and LOW alarm indicators will light whenever there is an alarm condition associated with the CO₂% within the chamber. The MUTE indicator will light whenever the audible alarm has been deactivated.
- 4.10 **CO₂ INJECTING:** This pilot lamp is on whenever the Carbon Dioxide control has been activated and is actively injecting CO₂ gas via the solenoid valve.
- 4.11 **PASS BOX CONTROL:** The "START PASS BOX PURGE" button when engaged will actively initiate a PASS BOX purging cycle. The cycle time is ~45 seconds.
- 4.12 **PASS BOX PURGING:** This pilot light is on whenever the PASS BOX PURGE button has been pressed. The light will blink for the duration of the ~45 second cycle.
- 4.13 **RS232:** Electrical connection for data logging and or calibration of the Oxygen, Carbon Dioxide and Temperature controls.

5. HOSE AND ELECTRICAL CONNECTIONS

- 5.1 A supply hose connects from the N₂ PORT fitting to a N₂ tank and regulator (CGA 580).
- 5.2 A supply hose connects from the CO₂ PORT fitting to a CO₂ tank and regulator (CGA 320).
- 5.3 N₂ and CO₂ Regulator Considerations:
 - 5.3.1 Ensure that you are using a dual stage regulator CGA 580 for N₂ and CGA 320 for CO₂. It is highly recommended that a good quality 0-60 PSI output range DUAL STAGE pressure regulator be used on the N₂ tank and CO₂ tanks. The dual stage regulator will have two pressure gauges. The high pressure gauge (0-4000 PSI) will indicate the pressure within the tank. The low pressure gauge (0-60 PSI) will indicate the output pressure on the supply hose to the chamber. Single stage regulators do not provide as stable performance as dual stage.

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- 5.3.2** Reading & Understanding Your CO₂ Tank Levels: Pure CO₂ is in a liquid state in the tank, and a constant vapor pressure is generated in the tank above the liquid level. The CO₂ is drawn off of the top as a gas. It is normal for the high pressure gauge on your regulator to start out reading 800 to 1000 PSI with a full tank. The same vapor pressure is maintained as long as any liquid is left in the tank. The reading will drop from 800 to 500 PSI quickly and will stay there for most of the duration of the tank. At the end of use, the pressure will drop quickly to zero to indicate that the tank is completely empty. When the last of the liquid has evaporated into gas then the pressure will drop rapidly as the gas is drawn off.
- 5.3.3** NOTE: Pressure from the regulator to the incubator should be set at 15 PSI. Models with additional internal regulators have pressure reduction to 10 PSI to prevent overshoot.
- 5.3.4** NOTICE: Only medical grade CO₂ should be used in your Bactrox. Failure to do so may damage the unit and void your warranty.

NOTE: Pressure from the regulator to the incubator should be set at 15 PSI. An additional internal regulator further reduces the pressure to 10 PSI to prevent overshoot.

- 5.4** Hose ports for the gas are provided on the upper left side of the unit. The Bactrox chamber has five access ports on the left side of the unit. See Diagrams Section page 33 (INTERIOR PLUMBING) for more details.
- 5.5** Install one end of the hose from the N₂ gas regulator of the gas tank to the port marked “**N2 PORT**” on the plumbing connections panel.
- 5.6** Install one end of the hose from the CO₂ gas regulator of the gas tank to the port marked “**CO2 PORT**” on then plumbing connections panel.

NOTE: CONNECTING HOSES. Hose connections are intended to be simple. Insert the hose into the barb until the hose stops.

- 5.7** Plug power cord from Bactrox into a suitable outlet. Refer to the Installation Section of this manual for additional information. Turn the power switch ON to verify power to the system.
- 5.8** When the power switch to the Hypoxic Chamber is activated, you should see a light in the back-lit power switch, the O₂ and CO₂ digital display panels illuminate, along with a readout of the incubator temperature. If any of these appear not to work, consult the Troubleshooting Guide.

6. THERMOELECTRIC CONDENSATE CONTROLLER

- 6.1** The thermoelectric condensate controller collects excess humidity and eliminates chamber condensation. Moisture is funneled into a tube for collection inside your chamber.
- 6.2** The thermoelectric condensate controller is located on the left side of the chamber interior behind circulation fan. A plastic tube drains excess moisture into the working chamber, on the back left side.
- 6.3** Place a container, e.g., glass flask or beaker, under the tube for collection. Empty the container DAILY.
- 6.4** Desiccants are not recommended in the chamber. Desiccants are drying agents that will pull moisture from your samples by removing humidity and leaving condensate.

7. INCUBATOR TEMPERATURE CONTROLLER/SET OVER TEMPERATURE

Under certain circumstances, samples placed directly on the bottom shelf may become too hot and dry out. Shelf spacers are provided to minimize this condition. Three spacers are provided for the BACTROX. Place these spacers on the bottom shelf. Note the slots go to the front and back.

- 7.1** Setting Incubator Controller: The incubator temperature controller regulates the incubator temperature by use of Up/Down buttons. To enter set point mode on the control, press either the Up or Down button one time. The digital display will start to blink, going from bright to dim. While blinking, the Digital Display is showing the set point. To change the set point, use the Up and Down buttons. If the buttons are not pressed for five (5) seconds, the display will stop blinking and will read the temperature of the unit. Note that the SET OVER TEMPERATURE knob should be turned to its maximum position, (clockwise) until the unit has stabilized at desired set

point temperature. Allow the incubator at least 24 hours to stabilize. Then re-calibrate the digital display to your reference thermometer, follow the calibration instructions. This incubator was calibrated at the factory at 37°C.

- 7.2** Setting Incubator Safety: First, set the control to the desired incubator temperature and then the INCUBATOR SAFETY to its maximum position. Allow 24 hours for stabilization before proceeding.
- 7.3** If, after 24 hours the temperature is not at desired level, adjust the SET TEMPERATURE up or down using the arrows until the precise desired temperature is achieved.
- 7.4** When stabilization at the desired temperature has been achieved, turn the SET OVER TEMPERATURE control knob counter-clockwise until the OVER TEMP ACTIVATED light comes on and audible alarm is activated. Next, carefully turn the SET OVER TEMPERATURE knob clockwise until the light is just off. The safety is now set; the OVER TEMP ACTIVATED light should remain OFF during normal operation.
- 7.5** NOTE: An accurate thermometer should be used inside the incubator as a reference when setting and calibrating the incubator temperature.
- 7.6** It is a good idea to mark the SET OVER TEMPERATURE label with the desired setting or position as a backup in case the knob is moved accidentally. If the OVER TEMP ACTIVATED light is on and audio alarm is activated at any time, check the SET TEMPERATURE controller setting to be sure that it is not set above the SET OVER TEMPERATURE setting.
- 7.7** **Alarm Controls and Display:** The temperature control, O₂, and the CO₂ control are both equipped with visual and audible alarms.
- Temperature Alarms: The temperature control has alarm indicators for high and low conditions that are activated whenever the actual temperature is 1°C above or below the set point.
 - O₂ Alarms: The O₂ controller has alarm indicators for high and low alarm conditions that are activated whenever the actual O₂% is 1% above or below the set point.
 - CO₂ Alarms: The CO₂ controller has alarm indicators for high and low alarm conditions that are activated whenever the actual CO₂% is 1% above or below the set point.
 - Audible Alarms: Both controls have audible alarms that are activated when either of the HIGH or LOW indicators is activated.
- 7.8** **Muting Audible Alarms:** The audible alarms can be muted for a single alarm occurrence by pressing and holding down EITHER the UP or DOWN button for several seconds until the alarm mutes. There is a built in delay of approximately 15 minutes on the occurrence of a LOW alarm. This time delay prevents the audible alarm from activating every time the door is opened and the temperature and CO₂ drops.

8. CO₂ CONTROL CALIBRATION

- 8.1** Manufacturer's Recommendation for Monitoring CO₂ Levels: CO₂ sensors are factory calibrated and, under normal circumstances, need no calibration. It is recommended that the accuracy of your CO₂ control system be monitored by measuring the actual CO₂ concentration on a weekly basis with a Fyrite or other measuring device. This should be done when the chamber has not been opened for an extended period of time, i.e. after the weekend, and should only take 1-2 hours.
- 8.2** Setting the CO₂ Control: Attach the supply hose from the CO₂ tank to the Bactrox CO₂ inlet fitting and turn on the CO₂ supply. Set the CO₂ control to the desired set point using the up and down arrows. The CO₂ level comes from the factory preset to OFF.
- 8.3** Adjusting CO₂ Display: After the Bactrox has had several hours to stabilize at the desired CO₂ set point and measure the actual CO₂% with a Fyrite gas analyzer. If there is any difference between the Fyrite gas analyzer and the display, use the procedure described in section 7 page 14 for calibrating CO₂. See Section 9 Page 19 (next page) for Fyrite use and instruction.

NOTE: When using the Fyrite gas analyzer, insure that gas is not being injected while the reading is being taken. Always change the CO₂ set point to 0.0 prior to taking the sample and change the set point back to the desired value after the use of the Fyrite gas analyzer is finished.

- 8.4** Using a FYRITE to Measure CO₂ Levels
A Bacharach FYRITE CO₂ Gas Analyzer is recommended to measure CO₂ concentrations in the Bactrox chamber. This test instrument is not supplied with the

Bactrox but is readily available from your dealer. Follow the instructions provided with each Fyrite instrument carefully to ensure correct and accurate readings.

Fyrite Quick Overview

- Press button on top of Fyrite canister to release CO₂ concentration. RELEASE BUTTON and tip canister to the side to ensure all fluid is released from the top of the canister. Return canister to the upright position.
- Loosen screw on slide scale and align top of fluid with zero on the scale. Tighten screw.
- Connect hose and aspirator bulb to unit being tested. The sample port for connection is located on the control panel.
- Place the hose sampling cap directly over the plunger valve on top of the canister and depress firmly.
- With button depressed, squeeze bulb 20 times. On the last squeeze and with bulb still deflated, release hose from button.
- Turn Fyrite canister upside down 3 times, each time allowing all fluid to flow to the opposite end of the canister.
- Tilt canister to the 45 degree position to ensure all fluid has been released from top of canister. Return canister to the upright position.
- Read CO₂ concentration in %.

WARNING: The fluid used inside this fyrite instrument is poisonous and corrosive. If taken internally could result in serious injury or death. The fyrite indicator will come with a complete set of detailed instructions which should be followed carefully. In the event of a spill or accidental body contact with the fyrite fluid, follow the instructions on the refill bottle carefully.

9. OXYGEN CONTROL CALIBRATION

- 9.1** There are two recommended methods of calibration, depending on equipment availability and the accuracy required over a wide range of percent Oxygen. Calibration is done using room air (20.7% O₂ is an average value based on the humidity and partial pressure of O₂ in the atmosphere. This value should be calculated for your present environmental conditions.) and a tank of certified tank of oxygen and nitrogen mixture. An example would be a dry 5% oxygen and 95% nitrogen mixture.
- 9.2** Offset calibration can be done through front panel display buttons. See the OFFSET Calibration section below.
- 9.3** To complete a two point linear calibration the Bactrox needs to be hooked up to a computer that has RS-232 capability with windows terminal or internet access to download TERATERM off the web. Calibration should be done before chamber use.
- 9.4** To calibrate first install the calibration cover onto sensor box in figure 1, using the two screws provided.



Figure 8

9.5 TWO POINT CALIBRATION PROCEDURE

- 9.5.1 The two point calibration procedure requires a terminal emulator program. Shel Lab recommends the free, open source emulator **Tera Term**.
- 9.5.2 Tera Term can be downloaded for free from the developer's project page <http://tssh2.sourceforge.jp/index.html.en>. Follow the instructions to download and install the emulator.
- 9.5.3 Once the software has been installed hook up the RS232 DB9 cable to the back of the oxygen controller. If the computer has a RS232 port, plug the other end of the DB9 cable to the RS232 port. If the computer has only USB use the USB to RS232 adaptor provided with the calibration kit.
- 9.5.4 The oxygen concentration in the chamber will fluctuate during the calibration procedure. Sensitive items should be removed or placed in sealed containers if varying levels of O₂ will have a negative impact.
- 9.5.5 Turn on the Bactrox and allow 5 minutes for the oxygen sensor to warm up. The oxygen sensor needs to warm up before it can start reading oxygen levels accurately.
- 9.5.6 Turn on the computer and open the TERATERM software and click the serial button in the pop up window and click OK.
- 9.5.7 The controller should start logging once every minute. If it does not log, close TERATERM and reopen it again but, before clicking okay try another com port. Once the control starts to log into TERATERM, communication has been established.
- 9.5.8 If you would like to save the oxygen readings to a log file. Click on the File tab. Then the Log tab. Then create a filename to save your data in. Click OK. Data will now be saved into that file as reading is taken.
- 9.5.9 Plug in the Oxygen Calibration Pump into an electrical outlet and press the power button to turn on the pump. Hook up the hose to the calibration port on the left hand corner of the unit.
- 9.5.10 Set the O₂ set point to OFF. Push the Set Oxygen% down arrow and release. When the green Oxygen % display starts flashing, push and hold down the down arrow until the display reads "OFF". Let the control stabilize at atmosphere for at least 5 minutes.
- 9.5.11 Before a calibration can be completed you must type BRO2=0. Setting this value to "0" will allow the controller to be accessed and calibrated.
- 9.5.12 Before a two point calibration is performed the offset calibration must be set to 0. To view the current offset type OC2 and press enter. To set the offset calibration to zero subtract the offset value from the current display reading (if it is a positive number), then type in OC2= (the result of display-offset). If the offset calibration value is a negative number then add the absolute value back to the current display reading OC2=(the result of display -offset). Check that the Offset value is truly zero by typing "OC2" and "enter". If the readout then displays OC2=0, then proceed to the next step.
- 9.5.13 If the display does not read 20.7 percent oxygen concentration then an upper calibration should be entered.
- 9.5.14 To enter an upper calibration type in UC2=20.7 in uppercase in the TERATERM program. The TeraTerm window will display UC02=20.7. The digital "SET O₂%" display should now read 20.7 percent oxygen. Remove the Calibration pump tubing from the calibration port.
- 9.5.15 Hook up the certified calibration gas to the calibration port and turn the gas on with the regulator set no higher than 3 PSI. Allow the control and sensor to stabilize for at least 5 minutes.
- 9.5.16 If the display does not match to what the certified calibration gas states then a low calibration needs to be entered.

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- 9.5.17 To enter a low calibration, type in LC2= (value of certified calibration gas) in uppercase in the TERATERM program. The display will show LC2=(value of certified calibration gas)
 - 9.5.18 Unhook the calibration gas and reconnect the Calibration O₂ pump box again and allow at least 5 minutes for the sensor to stabilize. This will show the curve is still accurate over the full range.
 - 9.5.19 The display should return to 20.7 percent. Remove the tubing from the calibration port barb. Replace the barb plug/cap.
 - 9.5.20 Remove calibration cover. Two point calibrations are now complete.
 - 9.5.21 Set the main "SET OXYGEN %" display to the desired setpoint via the up and down arrows. Allow the reading to stabilize before use.

9.6 OFFSET CALIBRATION PROCEDURE

- 9.6.1 The second method of calibration does not require a computer. It requires a calibration gas selected to match the process the chamber is going to be used. Offset calibration is a single point calibration and should only be used in applications where having an absolute linear curve throughout the O₂ range is not an issue. Users should obtain calibration gas at a concentration that matches the value where the chamber is going to be operated.
- 9.6.2 To calibrate install the calibration plate. FIGURE 1.
- 9.6.3 Hookup the calibration gas to calibration port FIGURE 2.
- 9.6.4 Turn the calibration gas on with the regulator set no more than 3 PSI.
- 9.6.5 Allow the control to stabilize for at least 5 minutes.
- 9.6.6 If display does not match what the certified calibration gas states then an offset calibration needs to be entered.
- 9.6.7 To enter the offset calibration push and hold both up and down arrow simultaneously until "CO" flashes and then the current display value flashes then release the buttons.
- 9.6.8 While the current display value is flashing, use the up or down arrow to change the value in the display to match the calibration gas.
- 9.6.9 After the value is entered the display will stop flashing after 5 seconds if no buttons are pushed returning to normal operation. The display should now match the calibration gas.
- 9.6.10 Remove the calibration gas and calibration cover. It is important to note that a single point calibration may cause O₂ readings outside of the calibration gas to be incorrect.

10. POWER ON THE BACTROX:

- 10.1 Check power supply against unit plate and make sure they match. Be certain that the fuse is installed in the power inlet of the unit. Start by attaching the cordset (supplied with the accessories) to the unit inlet and the building power supply. Attach the female end of the cordset into the fused and recessed male plug on the rear of the unit and the male plug end of the cordset into the building supply receptacle.
- 10.2 Check that the appropriate plumbing connections have been made for N₂ and CO₂ supply.
- 10.3 Turn the power switch to the I/ON position. Operating temperature must be set, achieved and calibrated before CO₂ connection and adjustments are made. Set the CO₂ control setpoint to OFF. To do this, press and release the down arrow Button. The display will flash "SP" and then a number. While the number is flashing, press the down arrow button and hold it down until the display is flashing "OFF", then release the button. Then press the down arrow until the CO₂ setpoint is "OFF".
- 10.4 **Muting Audible Alarms:** Powering the unit on prior to calibration may activate the built in alarm system. To mute the alarm hold EITHER the up or down button until the "mute" indicator activates.

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- 10.5 Initial Control Settings:** Each Bactrox comes preset from the factory at 37C and the O₂ and CO₂ set to off. You should allow the incubator to heat up and stabilize for 24hrs. Turn the SET OVERTEMPERATURE control clockwise until it stops so that it does not activate during the initial warm up.
- 10.6** Calibrating the Controls for Temperature or CO₂:
- 10.6.1** Push and hold BOTH the UP and DOWN buttons simultaneously for five (5) seconds.
- 10.6.2** If you are calibrating temperature, the Temperature Display panel will read “CO” and then blink.
- 10.6.3** If you are calibrating CO₂ Level, the CO₂ will read “CO” and then blink.
- 10.6.4** While the display is blinking use the UP and DOWN buttons to adjust the display to match the actual condition in the incubator chamber.
- 10.6.5** If no buttons are pressed within five (5) seconds the blinking will stop and the display will revert to showing the process or actual parameter within the incubator chamber.

11. MAKING THE CHAMBER HYPOXIC

- 11.1** Prior to Purging the Chamber: Turn Power switch to the “O” (Off) position.
- 11.2** Connect Nitrogen and Carbon Dioxide Gas supplies as directed in the Bactrox Appendix.
- 11.3** Open the incubator doors before leaving the chamber. This allows the incubator to become hypoxic at the same rate as the workspace.
- 11.4** Put arm port doors in place, or the Arm Port Sleeve Plugs

NOTE: The Bactrox chambers have an efficient method for sealing the chamber by utilizing the Arm port doors as shown in Figure 3. The tightening knob on the Arm port doors should be snug, DO NOT OVER TIGHTEN. Damage can occur if too much force is placed on the Arm port door assembly. When the knob just begins to “grab”, the tightening bolt has reached its maximum point. Over tightening will cause the bolt to slip inside the handle and cause leakage.

Purging the Chamber

- 11.5** Turn Power Switch to the “I” (On) position on the Control Module.
- 11.6** Note the reading on the gas regulators.
- 11.7** Set the Oxygen Setpoint to the desired value using the up and down arrows.
- 11.8** Set the Carbon Dioxide Setpoint to the desired value using the up and down arrows.
- 11.9** The Oxygen controller will automatically add Nitrogen gas or ambient air to achieve the desired setting. Normally, it takes 1-1/2 to 2 hours to achieve a 1% concentration of O₂ inside the chamber workspace, after initialization from ambient air.
- 11.10** The CO₂ control module will automatically add Carbon Dioxide gas or Nitrogen to achieve the desired setting. Normally, it takes ~45 minutes to achieve a 1% concentration of CO₂ inside the chamber workspace, after initialization from ambient air.
- 11.11** If a precise control of the O₂ concentration is required, refer to the calibration section of this manual, to enter a custom calibration. The O₂ module is calibrated at the factory for two point curve at 1% and 20.7%.

Summary

The chamber is ready when:

- The “SET OXYGEN %” led display reads the desired concentration of oxygen.
- The “SET CO 2%” led displays reads the desired concentration of oxygen.
- The “SET TEMPERATURE” controller displays the desired value. NOTE: It may take several hours to overnight to achieve temperature stability after the incubator doors are closed after initialization.

12. PASS BOX OPERATION

- 12.1** Load the PASS BOX with samples, materials, supplies, etc.
- 12.2** Close the outer and inner PASS BOX Doors.
- 12.3** Activate the PASS BOX

12.3.1 Locate the “START PASS BOX PURGE” switch which should be in the bottom OFF position.

NOTE: Do not hold Auto Cycle Start Switch down. Simply press the button and let go to activate.

12.3.2 Press the “START PASS BOX PURGE” switch once to initiate the cycle. The PASS BOX will purge nitrogen thru the PASS BOX for 45 seconds. The **PASS BOX PURGING** light will alternately flash on and off, indicating the cycle is in progress. When the cycle is complete, the system will stop automatically and the **PASS BOX PURGING** light will turn off. This light will NOT remain on after a cycle is complete.

12.3.3 If the cycle does not follow the sequences in the previous section on consult the Troubleshooting Guide for adjustments. NOTE: Do not hold “START PASS BOX PURGE” switch down. Simply Press the button and let go to activate.

12.3.4 If you want to abort the cycle, press and hold the “START PASS BOX PURGE” switch for 5 seconds. Then the “PASS BOX PURGING” pilot light will stop flashing.

13. ENTERING THE CHAMBER

13.1 The rubber cuffs of the sleeve should be secured around your arm as opposed to clothing.

Remove sharp objects such as rings, watches, bracelets, etc., as they may damage the cuffs.

13.2 Insert your hands and forearms into the sleeves. The cuffs must be firmly secured around your bare forearms.

13.3 Loosen the arm port door knobs a few turns by turning the black wing nut counterclockwise, and rotate the locking bars to a horizontal position. The arm port doors can now be pushed forward into the chamber interior and can be secured on the arm port door holders.

NOTE: Arm movements that are too forceful may cause the sleeves to dislodge from the arm ports.

14. EXITING THE CHAMBER

14.1 Doors are used to seal the Arm ports while the chamber is not in use. Doors can be stored using the holders provided while the chamber is in use. Assembly consists of an Arm port door, tightening knob and locking bar. Doors are secured by turning the locking bars horizontally to pass through the cutouts in chamber, then turning locking bars vertical and tightening the knobs.

14.2 Before leaving the chamber the incubator doors and the inner PASS BOX door must be closed.

14.3 Hold the locking bars in a horizontal position, and close the doors. Rotate the locking bars to a vertical position, and gently tighten the black wing nut on both arm port door knobs, just until they “grab”.

14.4 When the arm port doors are properly sealed, slowly and carefully withdraw both arms from the sleeves.

15. MAINTENANCE

15.1 DAILY/ROUTINELY: Before using any cleaning or decontamination method except those recommended by the manufacturer, users should check with the manufacturer that the proposed method will not damage the equipment.

15.2 Remove and/or empty condensate collection container.

15.3 Disinfect the chamber interior. Do not use any volatile cleaning compounds such as alcohol, bleach or volatile ammonium based cleaners as these compounds will create a toxic environment for the growth of the microorganisms. Do not use alcohol based cleaning products on the Plexiglas.

15.4 Check the cuffs on the sleeve system. If the cuffs have holes or any tears, replace.

15.5 Check incubator temperature.

15.6 Record gas tank readings.

15.7 Change/Rejuvenate Anatox. Anatox absorbs volatile fatty acids and hydrogen sulfide in the chamber. Recommended use is 250 grams placed in a beaker in the chamber. Anatox-1000 grams (packaged in 250 gram packages)

Instructions:

- Empty two (2) 250 gram packages into two (2) separate 500 ml Pyrex beakers.
- Day one – place one beaker in the chamber (new Anatox can be placed directly into the chamber).

- Day *two* – remove beaker in the chamber and replace with the second beaker of Anatox (also new).
- Day *three* – reactivate the first beaker of Anatox by heating at 160°C for 2 hours. Then replace the beaker in the chamber with this reactivated beaker.
- Day *four* – *six months* – continue switching the reactivated beakers daily until six months is complete, then discard the old Anatox and repeat the procedure again.

16. ACCESSORIES

Tank Switch

Switches and monitors dual gas tank supply. Provides automatic switch-over to second gas tank alarm sounds when both tanks are empty. Tanks can be switched manually at any time.

Model # 2002-B

Nitrogen Gas Regulator

Optional accessory used in a two gas chamber
Part # 7150500

Cleaner

Benzalkonium Chloride

Chamber Stand

Provides work bench to support Bactrox chambers. Chamber Stand height 30". Stands feature locking casters and storage space.

CO2 Gas Regulator

Optional accessory used in a two gas chamber
Part # 7150500

Plexiglas Cleaner

#1060503-8 oz size

Plexiglas Scratch Remover

#1060504-8 oz size

ACCESSORIES PARTS LIST

<u>Catalog No.</u>	<u>Product</u>
5110729	Petri-Plate Rack 2x13
	Sleeves, Complete
	<i>Small</i>
9990738S	<i>Medium</i>
9990738M	<i>Large</i>
9990738L	UV Light Source
9490507	Start Up Kit
9490512	Rubber Cuffs, Sm Size 7
3600500	Rubber Cuffs, Med Size 8
3600501	Rubber Cuffs, Lrg Size 9
3600502	O-Ring For Door
6000501	O-Ring For Cuff
6000504	Gasket-Airlock
3450506	Nitrile Gloves-Size 7
3600513	Nitrile Gloves-Size 8
3600514	Nitrile Gloves-Size 9
3600515	Nitrile Cuffs-Size 7
3600525	Nitrile Cuffs-Size 8
3600526	Nitrile Cuffs-Size 9
3600527	Rubber Cuff Plugs
7200502	

CAUTION: *Extreme caution must be exercised any time access is made into areas housing electrical components. Repair, replacement or adjustment of components in these areas must only be done by qualified technicians familiar with electrical circuitry and the operation of the hypoxic chamber.*

ATTENTION: Des Précautions extrêmes sont requises à chaque fois que vous accédez à des endroits qui abritent les composantes électriques. La réparation, le remplacement ou l'ajustement de composantes dans ces endroits ne doivent être effectués que par un technicien qualifié familier avec les circuits électriques et l'opération des étuves anaérobiques.

17. TROUBLESHOOTING

I. PASS BOX

Problem	Possible Cause	Solution
PASS BOX Purge will not start.	A. Input/output terminal buss is not seated correctly. B. User pushed start switch and held inadvertently held down. Thus aborting Auto Cycle. D. Start button inoperative - E. No power to controller - check power light on Controller.	A. Press down on the terminal buss so that it snaps into place. <i>NOTE: Power should be turned off.</i> B. Push start switch once then release. D. Replace start button. E1. Check for 24 volt DC out of power supply. E2. Check for continuity between power supply and controller.

II. INCUBATOR

Problem	Possible Cause	Solution
Steady digital readout matches set point, but actual temperature does not.	A. Temperature Controller out of calibration. B. Incubator door open.	A. Follow Complete Temperature Controller instruction. B. Close incubator door and allow incubator to stabilize.
Digital readout and actual temperature continue to increase past set point.	A. Output relay stuck - Check to see if "Incubator Heating" Indicator light stays on while temperature is Increasing. B. Incubator door open.	A. Replace Temperature Controller. B. Close incubator door and allow incubator to stabilize.
Audible alarm sounds.	A. Temperature has risen beyond the set range for the High Limit Safety.	A. Determine cause of temperature increase from prior section and take appropriate action. Call for service.

III. MISCELLANEOUS

Problem	Possible Cause	Solution
Role of Condensate Controller:	The Condensate Controller is an exclusive Bactrox feature of Sheldon Manufacturing, Inc. Our competitors use desiccants. Desiccants are a drying agent and often dry out samples.	

Problem	Possible Cause	Solution
Amount of Water Collected in the Dehumidifier:	The amount of water collected in the dehumidifier depends on the number and types of samples in the chamber. The typical amount collected is around 50 cc each day of chamber use.	
Excessive moisture buildup in chamber.	A. Thermoelectric condensate controller fan is not operating. B. Ambient room temperature too low. C. Air conditioner unit directly above chamber. D. Thermoelectric condensate controller not emptied regularly.	A. Replace fan. B1. Maintain room temperature a bit higher. B2. Cover chamber with a blanket overnight as means of installation. C. Relocate chamber, redirect the air conditioning duct. D. Empty thermoelectric condensate controller container.

18. BACTROX OPERATION TIPS

Gas Source:	Sheldon Manufacturing, Inc. recommends an two separate tanks of 100% CO₂, , and 100% Nitrogen for Hypoxic applications. These mixtures are available marked “NON-FLAMMABLE”. Two national sources of gas are AIRGAS, PRAXAIR, and Air Liquid.
How much gas will a Bactrox chamber use?	Gas usage is dependent upon three things; the number of times a user enters their chamber daily, operating technique, and the number of PASS BOX purge cycles. Our product literature states the PASS BOX uses approximately 45 seconds of gas to purge the oxygen to appropriate hypoxic levels.
Methods to Conserve Gas:	Users can utilize the PASS BOX as a holding station. As samples are received they can be stored in a hypoxic environment by placing them in the PASS BOX and activating either the automatic or manual PASS BOX cycle. 1. Users should evaluate and try to limit the number of times the PASS BOX is cycled. For example, placing samples in the PASS BOX once in the morning and once in the afternoon as opposed to four times a day is desirable. 2. Gas is also conserved by bringing samples in through the sleeve system. Easy samples to transport through the sleeves are transport tubes as well as plates that are sealed. 3. Good sleeve system technique. When a user is in the “Working Area” they should be aware of the effects their movements have on gas consumption. Gas consumption can be reduced by balancing arm movements. For example, when extending the right arm into the chamber, bring the left arm close to the front of the chamber, thus balancing the pressure and reducing gas displaced by area.
Aborting PASS BOX PURGE CYCLE:	The automatic PASS BOX can be aborted by pressing and holding the “START PASS BOX PURGE” button for five (5) seconds. If a user forgets to place a sample in the PASS BOX the cycle can be aborted in order to eliminate the unnecessary use of gas.
Chamber Checklist:	It is recommended that customers review a checklist before they enter the Bactrox Chamber. The checklist serves as a reminder of supplies and samples they need to bring into the unit. Common items listed on a checklist are: re-activated anatox, samples and loops. The checklist can be placed on the front Plexiglas panel.
Size of Sleeve Cuffs:	It is critical that the sleeve cuffs seal around the user’s arm during chamber operation to ensure the desired hypoxic environment. The location that the cuffs seal on the user’s arm is determined by individual preference. The size of the cuffs that come standard with the Bactrox Chamber is medium, size 8 glove. Other sizes are available; large size 9, and small size 6 ½.
Replacement of Cuffs:	When and how often the cuffs on the sleeve need to be replaced depends on customer care and technique. Typically the cuffs are replaced about every three months. Customers should watch for small holes that can appear where the cuffs are placed on the “ring cuff”. If holes are present the cuffs should be replaced to avoid gas leak. Watches and jewelry can damage the cuffs and are not recommended to be worn during chamber use.

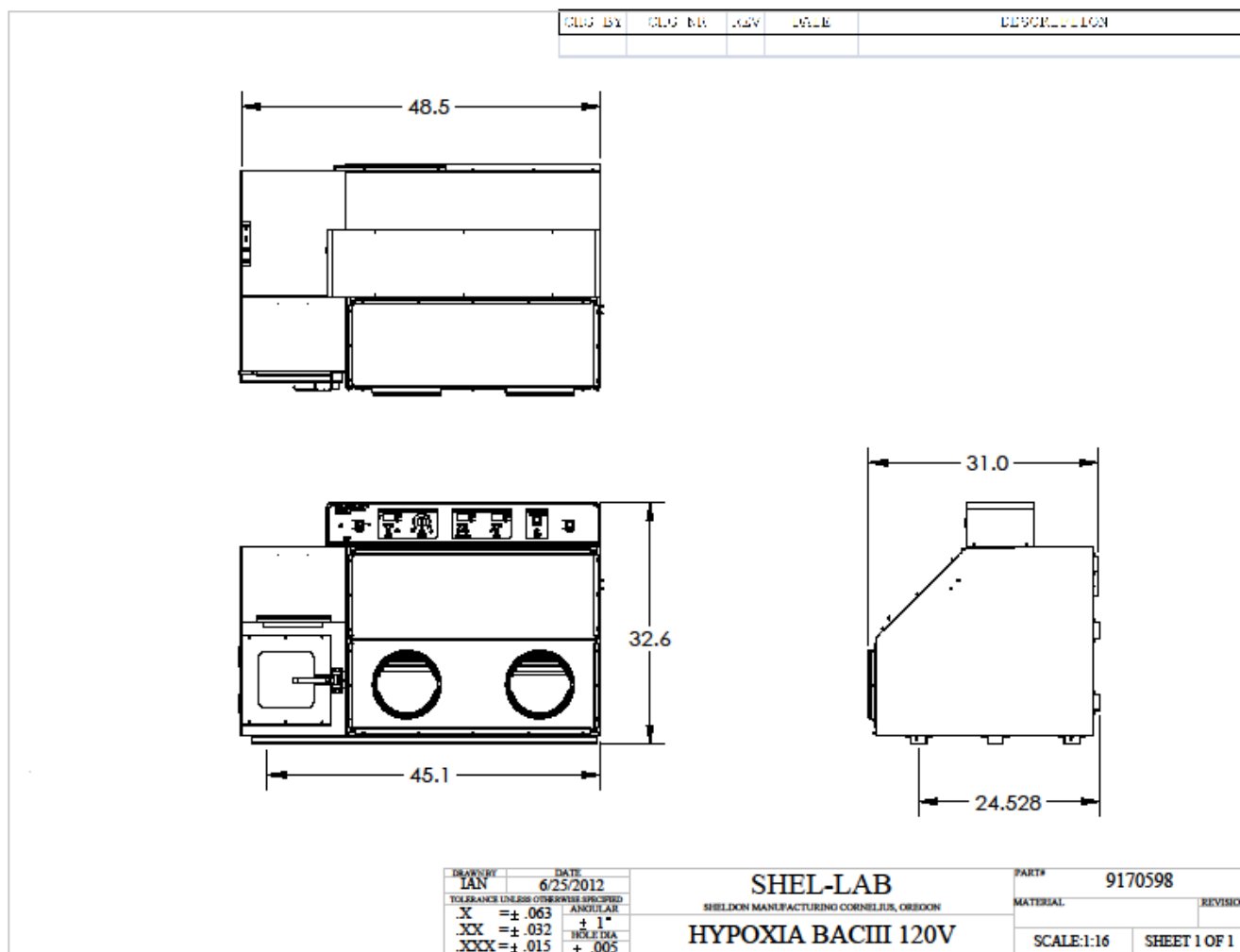
19. UNIT SPECIFICATIONS

Model Number	Interior Dimensions W x D x H (Inches)	Exterior Dimensions W x D x H (Inches)	Chamber Capacity	Shipping Weight	Unit Weight
BACTROX, BACTROX-2		48.5 x 31.0 x 32.6	300 plates		

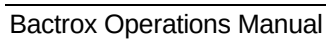
Model Number	Temperature Range (Control)	Temperature Uniformity	O2 Range	CO2 Range
BACTROX, BACTROX-2	Ambient + 8 to 60C (+/- 0.1C)	+/- 0.35C @ 37C	0-20%	0-20%

Electrical

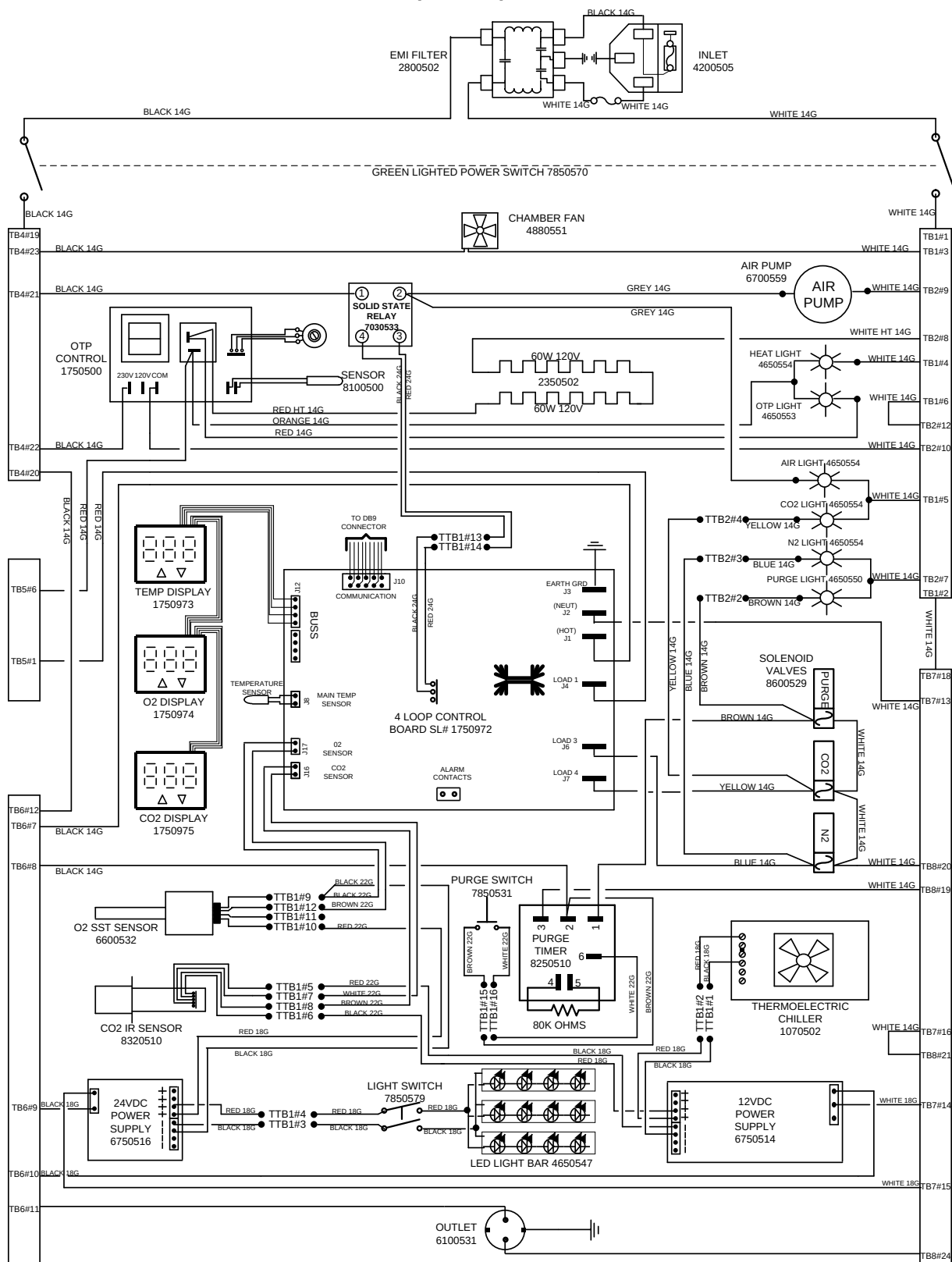
Model	Volts	Amps	VA	Cycles
BACTROX	120	3.5	1100	50/60 hz
BACTROX-2	240	2	1100	50/60 hz



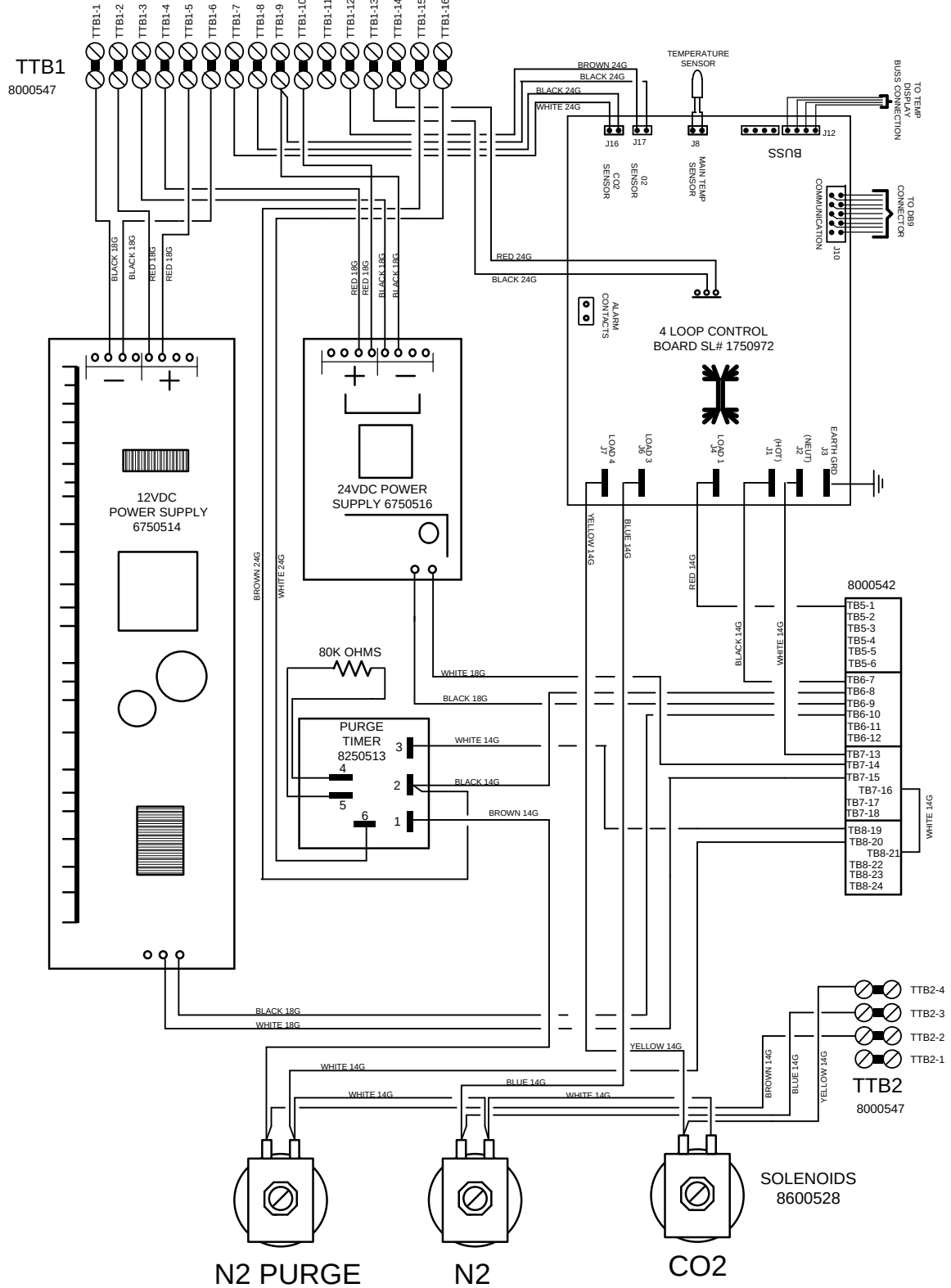
WIRING DIAGRAM BACTROX (9851358)



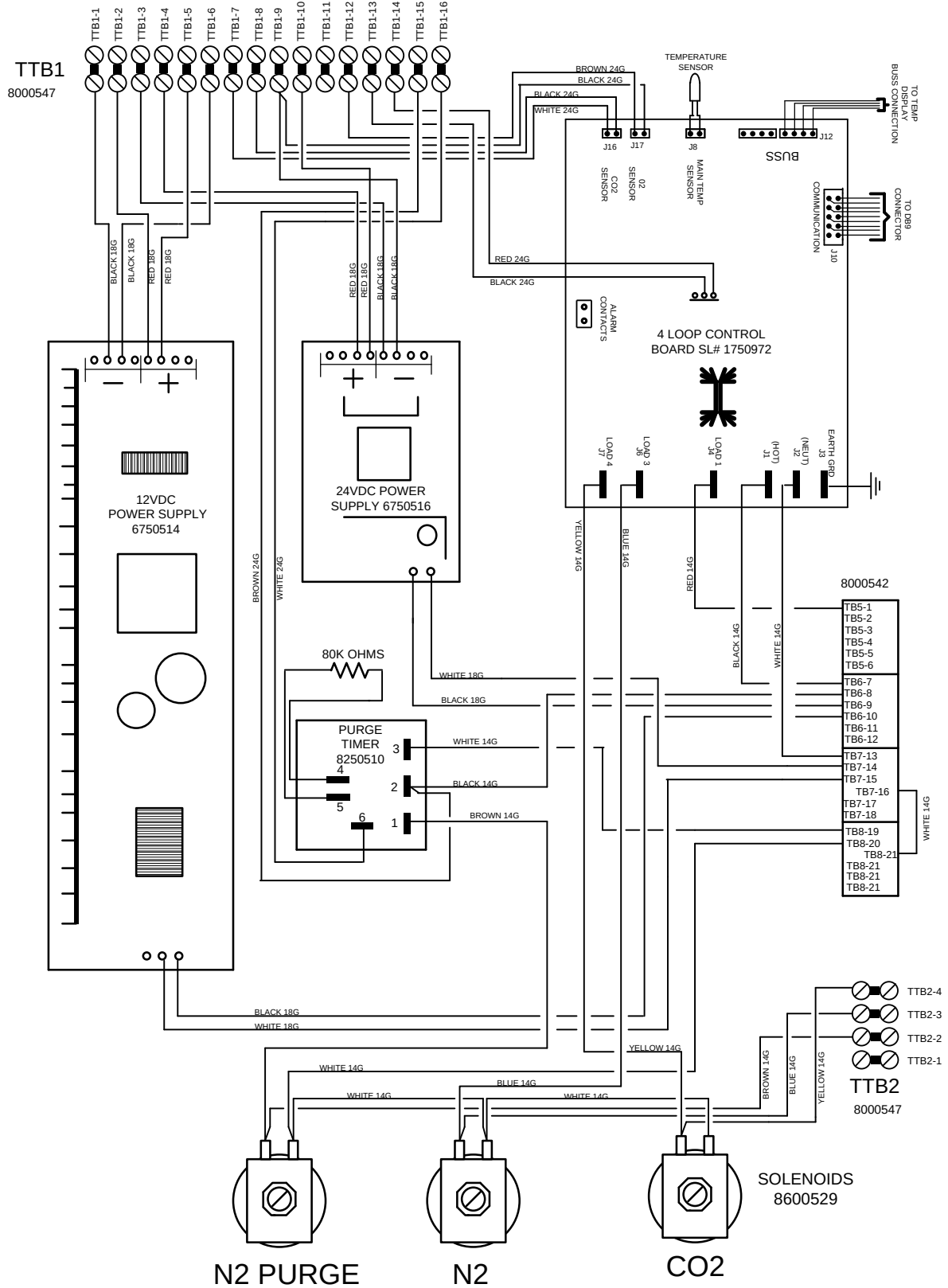
WIRING DIAGRAM BACTROX-2 (9851363)



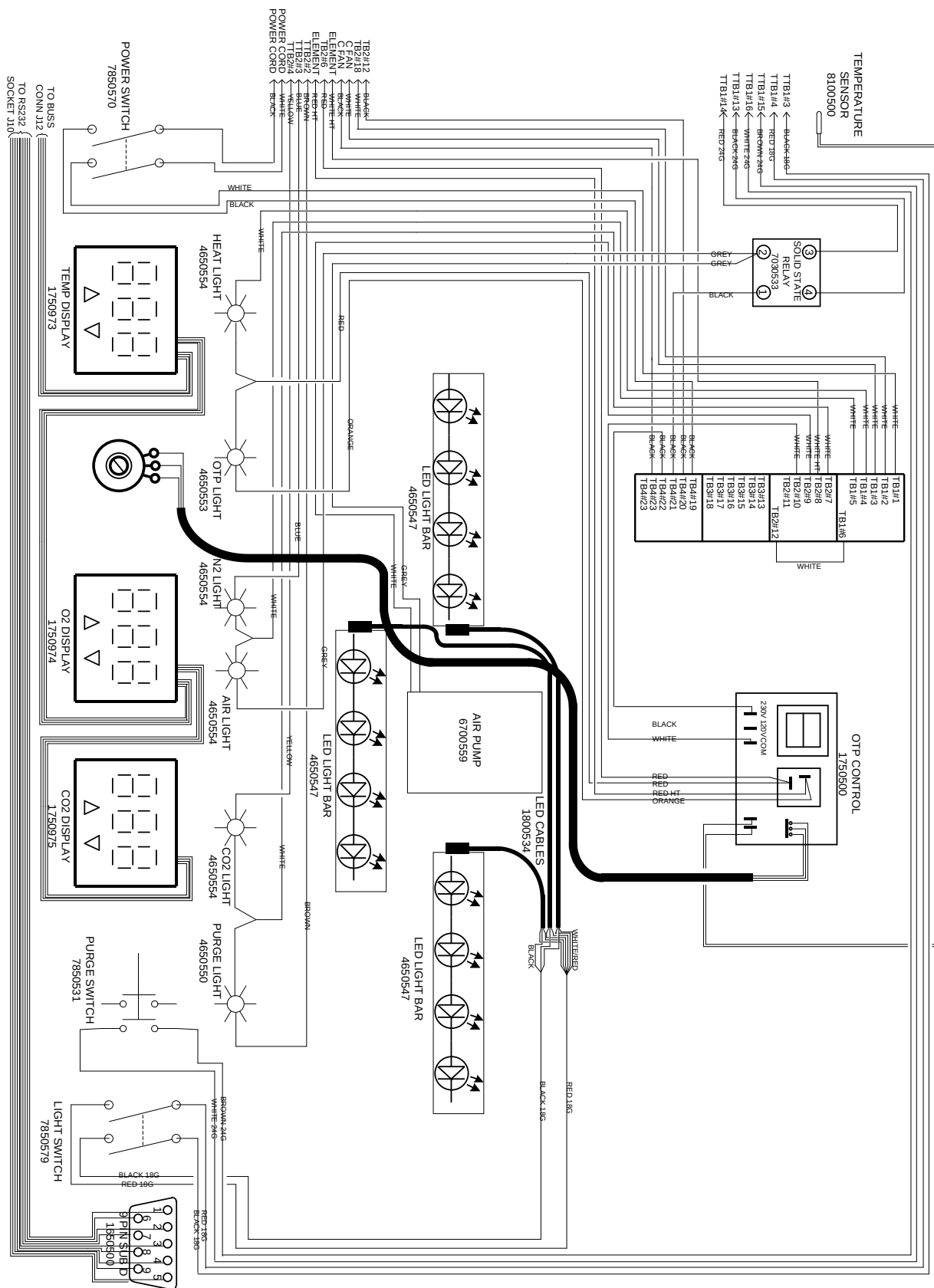
BACK PANEL BACTROX (9851359)



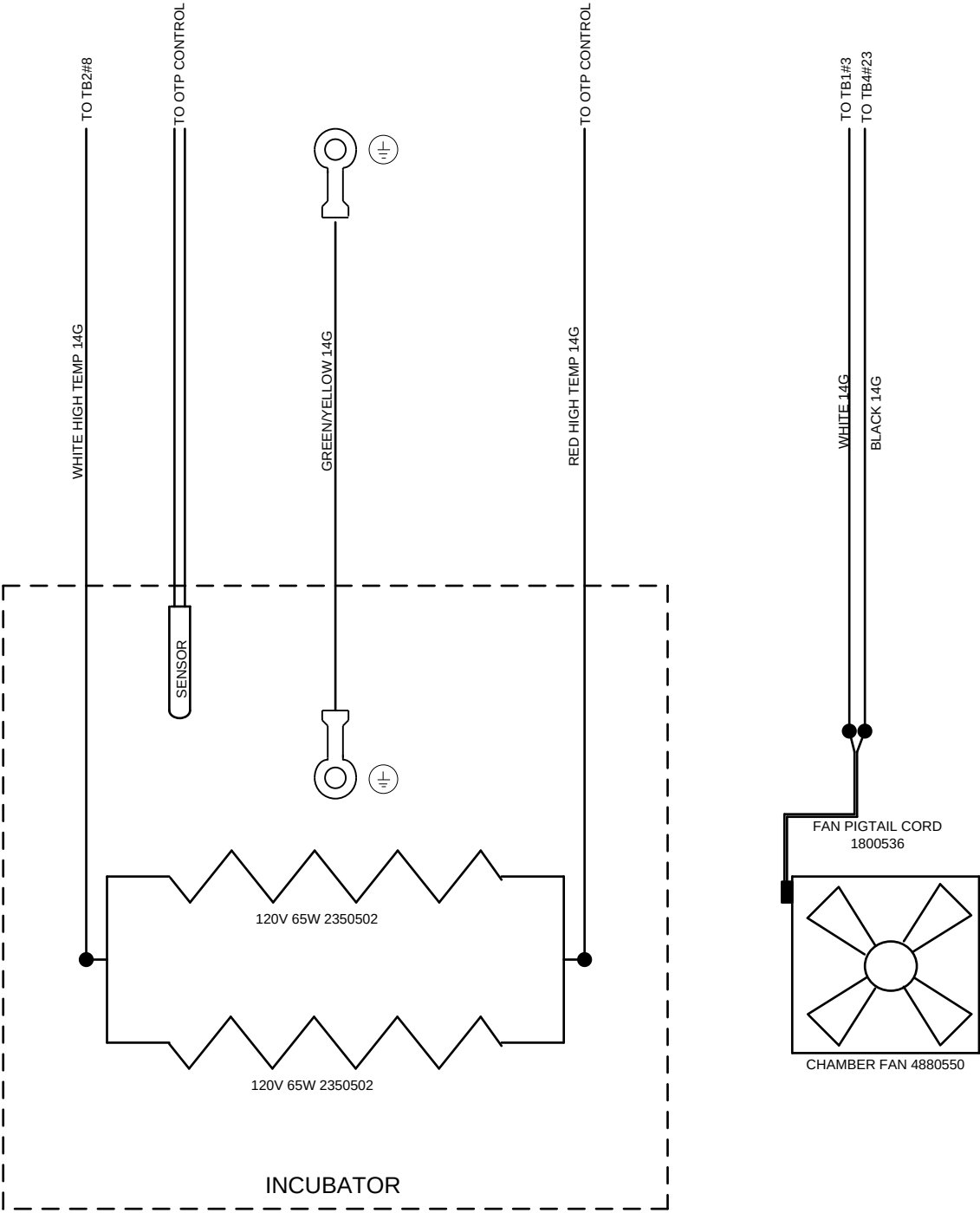
BACK PANEL BACTROX-2 (9851364)



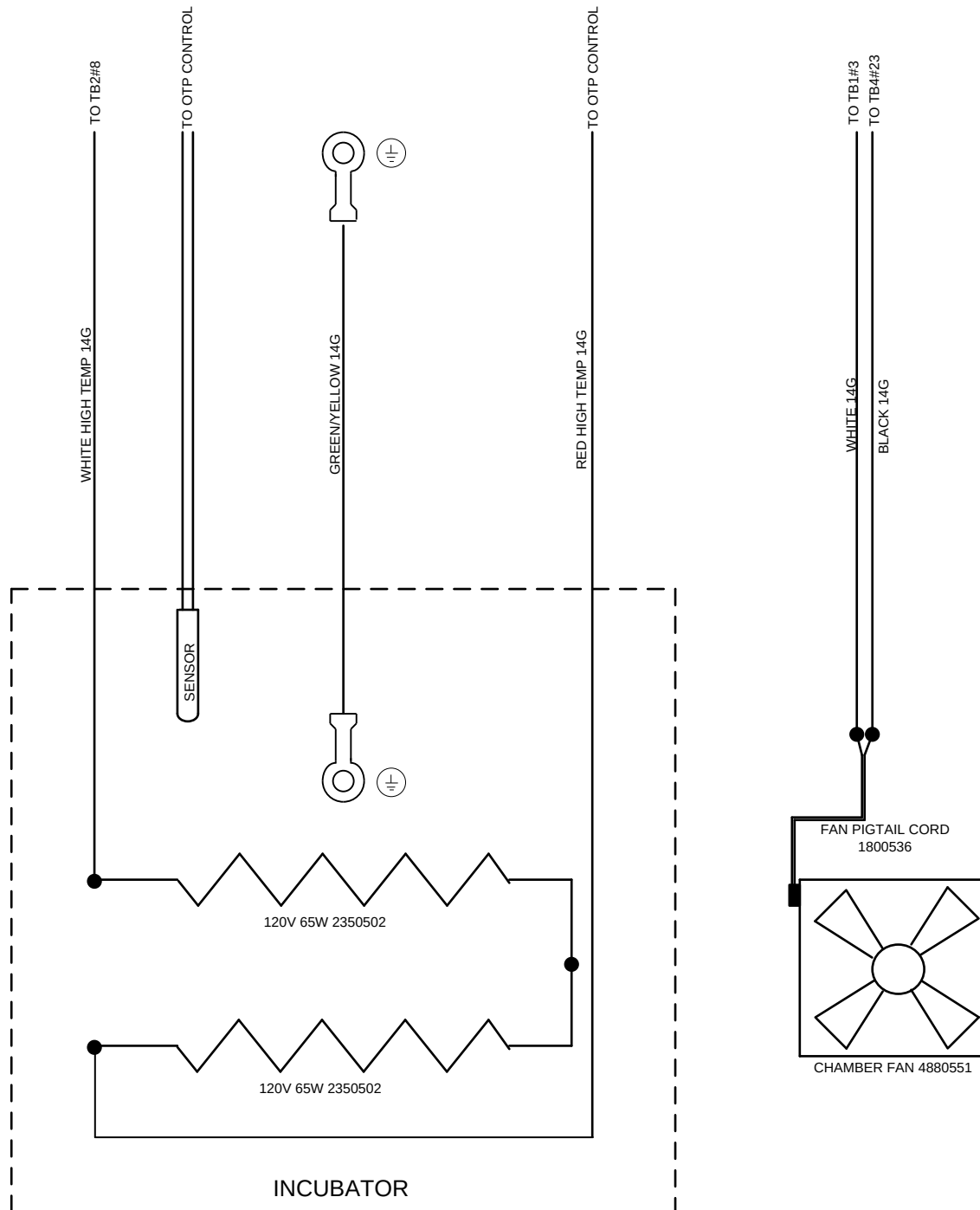
CONTROL PANEL BACTROX-2 (9851365)



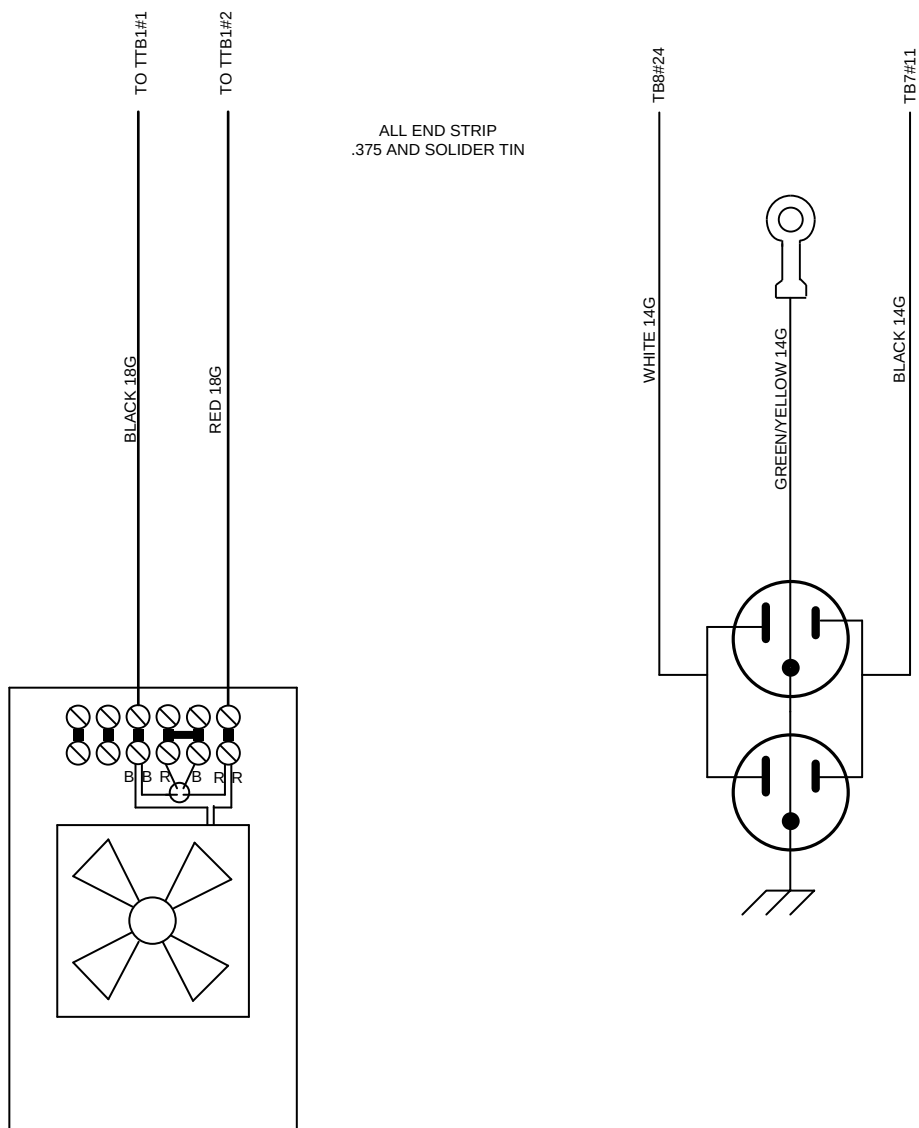
INCUBATOR & FAN BACTROX (9851361)



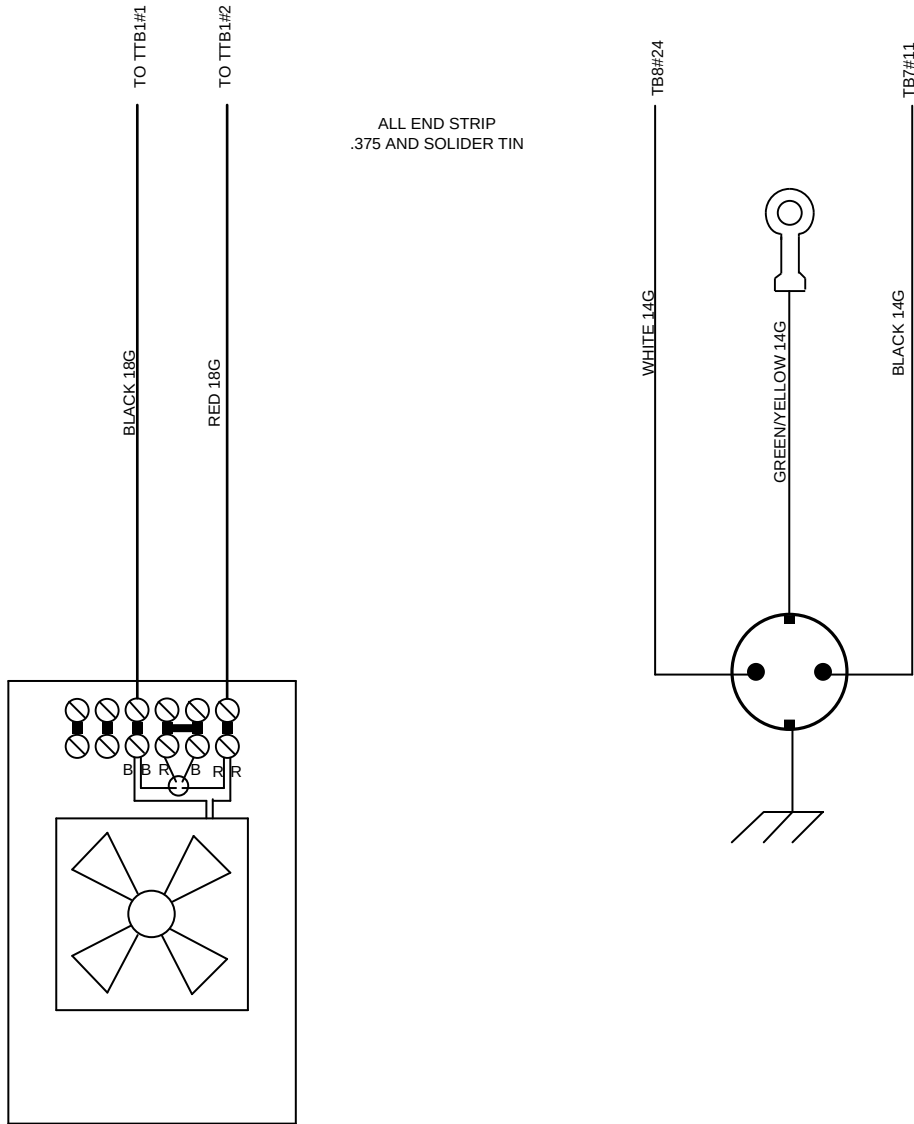
INCUBATOR & FAN BACTROX-2 (9851366)



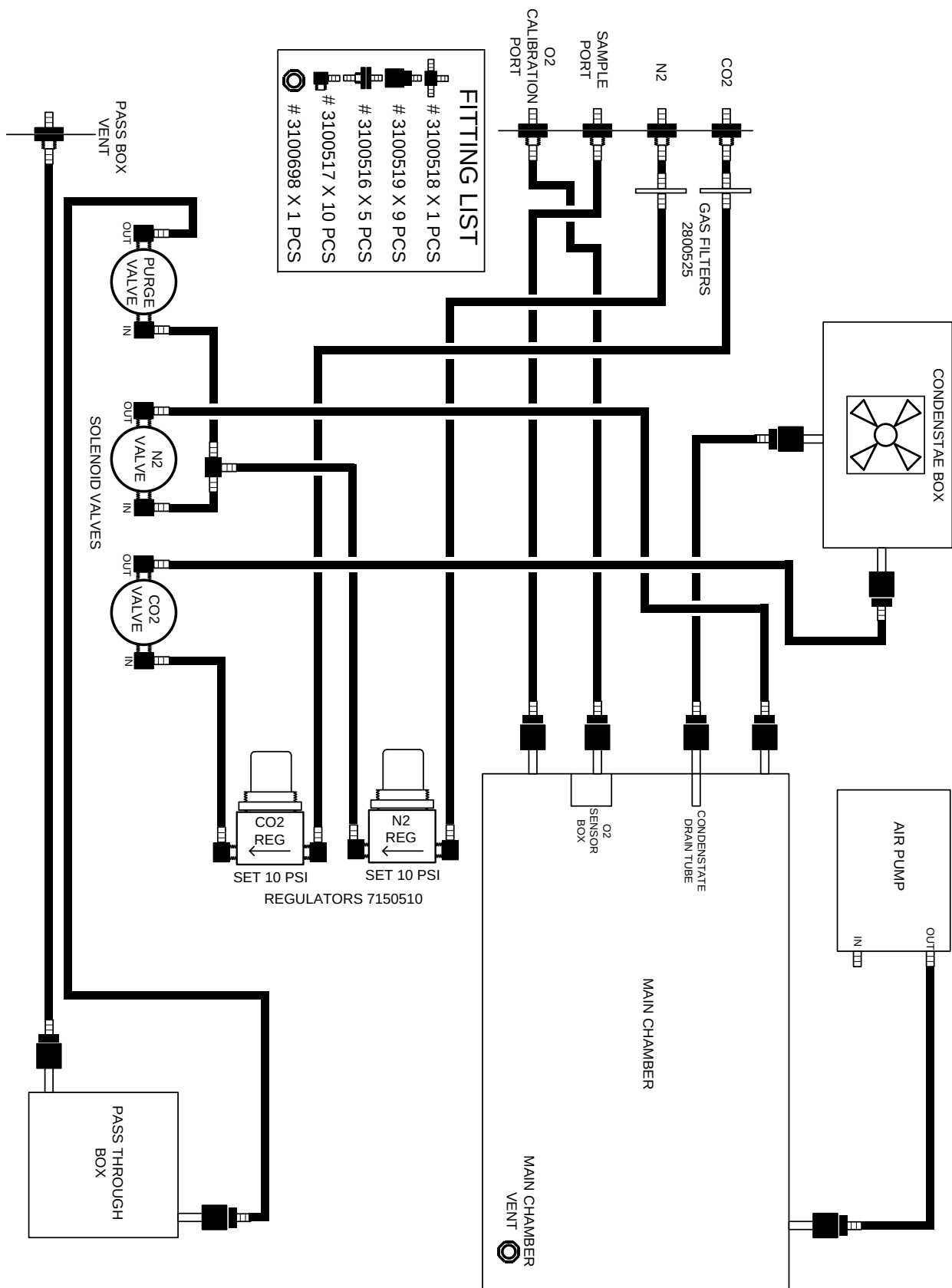
CHILLER & OUTLET BACTROX (9851362)



CHILLER & OUTLET BACTROX-2 (9851367)



20. PLUMBING DIAGRAM



21. BACTROX SPARE PARTS LIST

DESCRIPTION	PART NUMBER 115 VOLT	PART NUMBER 220 VOLT	QUANTITY
CHECK VALVE FILTER	8600573	8600573	1
CONTROL - OTL SAFETY	1750500	1750500	1
CONTROL - PLC	1750621	1750621	1
CONTROL - TEMPERATURE			1
CONTROL PROBE - OTP SAFETY	8100500	8100500	1
ELEMENT	2350502	2350502	2
GASKET 9 X 9 SOFT LT. BLUE	3450506	3450506	1
LIGHT – LED	4650547		1
LIGHT - OTP SAFETY	4650553	4650553	1
OTP SAFETY ALARM	0250501	0250502	1
OUTLET - VACUUM PUMP	6100525	6100531	1
POWER CORD	1800516	1800541	1
POWER CORD - BACLOOP / LIGHTBOX	1800516	1800541	1
SOLENOID - CHAMBER GAS	8600528	8600529	1
SOLENOID - GAS 1	8600528	8600529	1
SOLENOID - GAS 2	8600528	8600529	1
SWITCH - AUTO START/RESET	7850531	7850531	1
SWITCH - BACLOOP / LIGHTBOX	7850579	7850579	1
SWITCH - CHAMBER PRESSURE	7850524	7850524	1
SWITCH - LIGHT	7850529	7850529	1
SWITCH - MAIN POWER	7850570	7850570	1
SWITCH - MANUAL VAC/GAS	7850530	7850530	1
THERMOELECTRIC CONDENSATE CONTROLLER	1070502	1070502	1